AMENDMENT

To : Examiner of the Patent Office

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1. Identification of the International Application
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4. Object of Amendment Specification and Claims

5. Content of Amendment

(1) Specification p.4, Line 16, Specification p.5, Line 16, Specification p.7, Line 4, Claims p.24, Claim 1, Line 4, Claims p.25, Claim 5, Line 4, and Claims p.26, Claim 13, Line 4,

"electric magnet" is to be amended to "alternating gradient electric magnet".

(2) Specification p.4, Lines 21 -26,

"said electric magnet is an alternating gradient electric magnet, said

alternating gradient electric magnet consists of a converging electric magnet and a diverging electric magnet provided at both sides of said converging electric magnet, or of the converging electric magnet and a divergent part provided at both sides of said converging electric magnet," is to be amended to "an alternating gradient electric magnet forms a closed magnetic circuit consisting of a converging electric magnet and a diverging electric magnet provided on both sides of said converging electric magnet, or an alternating gradient electric magnet forms a closed magnetic circuit consisting of a converging electric magnet and a diverging part provided on both sides of said converging electric magnet, the coil part of the electric magnet making up the alternating gradient electric magnet has a divided coil structure, the respective currents of divided coil parts change the magnetic field coefficient k so that the respective currents of divided coil parts makes the magnetic field distribution in the diameter direction of a vacuum container $B = B_0 (r/r_0)^k$ (where B_0 is the magnetic field intensity on an input orbital, r_0 is an input orbital radius, and k is a magnetic field coefficient.), and control the zero chromatic aberration shape about the accelerated electron beam, the electron beam intensity and energy".

(3) Specification p.4, Lines 30 -33,

"said electron beam inputting part is preferably provided with an electron gun, and an electric magnet to change the orbital of the electron beam generated from said electron gun and input it into the vacuum container." is to be amended to

"preferably, said electron beam inputting part is provided with an electron gun and an electric magnet to change the orbital of electron beam generated from said electron gun, and input it into a vacuum container, and with the second electric magnet for adjusting the electron beam orbital near an electron beam inputting part of an alternating gradient electric magnet, an electron beam transporting part is provided with an electric magnet or a converging lens to change the orbital of electron beam to outside of a vacuum container, provided with the first electric magnet for adjusting the electron beam orbital near an electron beam outputting part of an alternating gradient electric magnet, and the orbital of electron beam is adjusted by the first and the second electric magnets for adjusting the electron beam orbital."

(4) Specification p.4, Lines 33 -35,

"Said electron beam transporting part is preferably provided with an electric magnet or a converging lens to change the orbital of the electron beam to outside of the vacuum container, and" is to be amended to
"Preferably, the".

(5) Specification p.5, Lines 18 -20 and p.7, Lines 6 -8,

"an electric magnet to output the electron beam accelerated in said vacuum container," is to be deleted.

(6) In Specification p.5, Line 15,

"comprising" is to be amended to "comprising".

(7) Specification p.5, Lines 22 -27,

"said electric magnet is an alternating gradient electric magnet, said alternating gradient electric magnet consists of the alternating gradient electric magnet and a divergent electric magnet provided at both sides of said alternating gradient electric magnet, or of the alternating gradient electric magnet and a divergent part provided at both sides of said alternating gradient electric magnet," is to be amended to
"an alternating gradient electric magnet forms a closed magnetic circuit consisting of a converging electric magnet and a diverging electric magnet provided on both sides of said converging electric magnet, or an alternating gradient electric magnet forms a closed magnetic circuit consisting of a converging electric magnet and a diverging part provided on both sides of said converging electric magnet, the coil part of the electric magnet making up the alternating gradient electric magnet has a divided coil structure, the respective currents of divided coil parts change the magnetic field coefficient k so that the respective currents of divided coil parts makes the magnetic field distribution in the diameter direction of a vacuum container $B = B_0 (r/r_0)^k$ (where B_0 is the magnetic field intensity on an input orbital, r_0 is an input orbital radius, and k is a magnetic field coefficient.), and control the zero chromatic aberration shape about the accelerated electron beam, the electron beam intensity and energy,".

(8) Specification p.5, Lines 27 - 28,

"the electron beam output from said electron beam transporting part" is to be amended to

"an internal target to generate X-ray is provided inside a vacuum container right before the accelerated electron beam transporting part, the accelerated electron beam and X-ray are selectively output, and electron beam or X-ray".

(9) Specification p.5, Lines 29 - 32,

"an internal target is preferably provided to generate X-ray in the vacuum container right before the accelerated electron beam transporting part, and the accelerated electron beam and X-ray can be selectively output." is to be deleted.

(10) Specification p.6, Line 8,

"consists of" is to be amended to "comprises".

(11) Specification p.6, Lines 29 - 32,

"the coil part of the electric magnet constituting the alternating gradient electric magnet preferably has a divided coil structure, and each current of the divided coil part is drive-controlled so that pre-designed magnetic field distribution is attained." is to be amended to

"each current of the divided coil part is drive-controlled by the resistance connected in parallel with each coil part, or by the current source connected to each coil part.".

(12) Specification p.7, Lines 10 - 18,

"said electric magnet is an alternating gradient electric magnet, said alternating gradient electric magnet consists of the converging electric magnet and a divergent electric magnet provided at both sides of said converging electric magnet, or of the converging electric magnet and a divergent part provided at both sides of said converging electric magnet, the coil part of the electric magnet constituting the alternating gradient electric magnet has a divided coil structure, and each current of the divided coil part is drive-controlled so that pre-designed magnetic field distribution is

attained." is to be amended to
"an alternating gradient electric magnet forms a closed magnetic circuit consisting of a converging electric magnet and a diverging electric magnet provided on both sides of said converging electric magnet, or an alternating gradient electric magnet forms a closed magnetic circuit consisting of a converging electric magnet and a diverging part provided on both sides of said converging electric magnet, the coil part of the electric magnet making up the alternating gradient electric magnet has a divided coil structure, the respective currents of divided coil parts change the magnetic field coefficient k so that the respective currents of divided coil parts makes the magnetic field distribution in the diameter direction of a vacuum container $B = B_0 (r/r_0)^k$ (where B_0 is the magnetic field intensity on an input orbital, r_0 is an input orbital radius, and k is a magnetic field coefficient.), and control the zero chromatic aberration shape about the accelerated electron beam, the electron beam intensity and energy.".

(13) Specification p.7, Line 20,

"controlled by the resistance" is to be amended to "controlled by the resistance".

(14) Specification p.7, Lines 33 - 34,

"said electron accelerator is a fixed-field alternating gradient electron accelerator." is to be amended to
"said electron accelerator is provided with a vacuum container, an alternating gradient electric magnet provided to inside or outside of said vacuum container, an electron beam inputting part to input electron beam into said vacuum container, an accelerating apparatus to accelerate electron beam, and an electron beam transporting part to transport the accelerated electron beam from said vacuum container, and an alternating gradient electric magnet forms a closed magnetic circuit consisting of a converging electric magnet and a diverging electric magnet provided on both sides of said converging electric magnet, or an alternating gradient electric magnet forms a closed magnetic circuit consisting of a converging electric magnet and a diverging part provided on both sides of said converging electric magnet, the coil part of the electric magnet making up the alternating gradient electric magnet has a

divided coil structure, the respective currents of divided coil parts change the magnetic field coefficient k so that the respective currents of divided coil parts makes the magnetic field distribution in the diameter direction of a vacuum container $B = B_0 (r/r_0)^k$ (where B_0 is the magnetic field intensity on an input orbital, r_0 is an input orbital radius, and k is a magnetic field coefficient.), and control the zero chromatic aberration shape about the accelerated electron beam, the electron beam intensity and energy, an internal target is provided to generate X-ray in the vacuum container right before an electron beam transporting part, and the accelerated electron beam and X-ray are selectively output, and electron beam or X-ray is scanned."

(15) Claims p.24, Claim 1, Lines 12 - 17 and Claims p.25, Claim 5, Lines 12 - 17,

"said electric magnet is an alternating gradient electric magnet, and said alternating gradient electric magnet is made up either with a converging electric magnet and divergent electric magnets provided at both sides of said converging electric magnet, or with a converging electric magnet and divergent parts provided at both sides of said converging electric magnet," is to be amended to

"said alternating gradient electric magnet forms a closed magnetic circuit consisting of a converging electric magnet and a diverging electric magnet provided on both sides of said converging electric magnet, or an alternating gradient electric magnet forms a closed magnetic circuit consisting of a converging electric magnet and a diverging part provided on both sides of said converging electric magnet, the coil part of the electric magnet making up the alternating gradient electric magnet has a divided coil structure, the respective currents of divided coil parts change the magnetic field coefficient k so that the respective currents of divided coil parts makes the magnetic field distribution in the diameter direction of a vacuum container $B = B_0 (r/r_0)^k$ (where B_0 is the magnetic field intensity on an input orbital, r_0 is an input orbital radius, and k is a magnetic field coefficient.), and control the zero chromatic aberration shape about the accelerated electron beam, the electron beam intensity and energy,".

(16) Claims p.24, Claim 2, Lines 2 - 5,

"provided with an electron gun, and an electric magnet to change the orbital of the electron beam generated from said electron gun, and to input the electron beam into said vacuum container." is to be amended to
"provided with an electron gun, and an electric magnet to change the orbital of the electron beam generated from said electron gun, and to input the electron beam into said vacuum container, and provided with an electric magnet for adjusting the second electron beam orbital near an electron beam inputting part of said alternating gradient electric magnet, said electron beam transporting part is provided with an electric magnet or a converging lens to change the electron beam orbital to outside of said vacuum container, an electric magnet for adjusting the first electron beam orbital is provided near an electron beam outputting part of said alternating gradient electric magnet, and said electron beam orbital is adjusted by said first and the second electric magnets for adjusting electron beam orbital.".

(17) Claims p.24, Claim 3, Lines 2 - 4,

"said electron beam transporting part is provided with an electric magnet or a converging lens to change the orbital of the electron beam to outside of said vacuum container, and" is to be deleted.

(18) Claims p.25, Claim 5, Lines 8 - 9,

"an electric magnet to output the accelerate electron beam in said vacuum container;" is to be deleted.

(19) Claims p.25, Claim 5, Lines 18 - 19,

"the electron beam output from said electron beam transporting part" is to be amended to
"an internal target to generate X-ray is provided in a vacuum container right before said accelerated electron beam transporting part, said accelerated electron beam and said X-ray are selectively output, and said electron beam or said X-ray".

(20) Claims p.25, Claim 6 is to be deleted.

(21) Claims p.25, Claim 8, Lines 2 - 3, "is provided with" is to be amended to

"comprises".

(22) Claims p.26 - 27, Claim 12, Lines 2 - 5,

"a coil part of the electric magnet constituting said alternating gradient electric magnet has divided coil structure, and each current of said divided coil part is drive-controlled so as to have the pre-designed magnetic field distribution." is to be amended to

"each current of said divided coil part is drive-controlled by the resistance connected in parallel with each coil part, or by the current source connected to each coil part.".

(23) Claims p.27, Claim 13, Lines 15 - 25,

"said electric magnet is an alternating gradient electric magnet, and said alternating gradient electric magnet is either an alternating gradient electric magnet made up with a converging electric magnet and divergent electric magnets provided at both sides of said converging electric magnet, or is made up with a converging electric magnet and divergent parts provided at both sides of said converging electric magnet, and

a coil part of the electric magnet constituting said alternating gradient electric magnet has divided coil structure, and each current of said divided coil part is drive-controlled so as to have the pre-designed magnetic field distribution." is to be amended to

"said alternating gradient electric magnet forms a closed magnetic circuit consisting of a converging electric magnet and a diverging electric magnet provided on both sides of said converging electric magnet, or an alternating gradient electric magnet forms a closed magnetic circuit consisting of a converging electric magnet and a diverging part provided on both sides of said converging electric magnet, the coil part of the electric magnet making up the alternating gradient electric magnet has a divided coil structure, the respective currents of divided coil parts change the magnetic field coefficient k so that the respective currents of divided coil parts makes the magnetic field distribution in the diameter direction of a vacuum container $B = B_0 (r/r_0)^k$ (where B_0 is the magnetic field intensity on an input orbital, r_0 is an input orbital radius, and k is a magnetic field coefficient.), and control the zero chromatic aberration shape about the accelerated electron beam, the electron

beam intensity and energy.".

(24) Claims p.28, Claim 16, Line 8,

"said accelerator is a fixed-field alternating gradient electron accelerator." is to be amended to

"said electron accelerator is provided with a vacuum container, an alternating gradient electric magnet provided to inside or outside of said vacuum container, an electron beam inputting part to input electron beam into said vacuum container, an electron beam inputting part to input electron beam into said vacuum container, an accelerating apparatus to accelerate said electron beam, and an electron beam transporting part to transport the accelerated electron beam from said vacuum container, and said alternating gradient electric magnet forms a closed magnetic circuit consisting of a converging electric magnet and a diverging electric magnet provided on both sides of said converging electric magnet, or said alternating gradient electric magnet forms a closed magnetic circuit consisting of a converging electric magnet and a diverging part provided on both sides of said converging electric magnet, the coil part of the electric magnet making up said alternating gradient electric magnet has a divided coil structure, the respective currents of said divided coil parts change the magnetic field coefficient k so that the respective currents of said divided coil parts makes the magnetic field distribution in the diameter direction of a vacuum container $B = B_0 (r/r_0)^k$ (where B_0 is the magnetic field intensity on an input orbital, r_0 is an input orbital radius, and k is a magnetic field coefficient.), and control the zero chromatic aberration shape about said accelerated electron beam, the electron beam intensity and energy, an internal target is provided to generate X-ray in the vacuum container right before said electron beam transporting part, said accelerated electron beam and X-ray are selectively output, and said electron beam or said X-ray is scanned."

6. List of Attached Documents

(1) Specification p.4, p.4/1, p.5, p.5/1, p.6, p.7, p.7/1

(2) Claims p.24, p.24/1, p.25, p.25/1, p.26, p.27, p.27/1, p.28, p.28/1

accelerator has so far not been realized as to have the acceleration voltage of higher than about 10 MeV required for radiation medical treatment, and to be set up easily in ordinary hospitals in general, and noise of audible frequency is generated from the accelerating apparatus and others to be used for acceleration.

Disclosure of the Invention

[0012] The object of the present invention is, referring to the above-mentioned problems, to offer a compact and light-weighted electron accelerator using a fixed-field alternating gradient with high electron beam intensity, and a radiation medical treatment apparatus using a fixed-field alternating gradient electron accelerator capable of electron beam irradiation in short time on cancer organism and others.

[0013] In order to achieve the object mentioned above, the electron accelerator of the present invention is the fixed-field alternating gradient electron accelerator comprising a vacuum container, an electric magnet provided to inside or outside of said vacuum container, an electron beam inputting part to input electron beam into said vacuum container, an accelerating apparatus to accelerate electron beam, and an electron beam transporting part to transport the accelerated electron beam from said vacuum container, characterized in that said electric magnet is an alternating gradient electric magnet, said alternating gradient electric magnet consists of a converging electric magnet and a diverging electric magnet provided at both sides of said converging electric magnet, or of the converging electric magnet and a divergent part provided at both sides of said converging electric magnet, an internal target to generate X-ray is provided in said vacuum container right before said electron beam transporting part, and the accelerated electron beam and X-ray can be selectively output.

[0014] In the aspect mentioned above, said electron beam inputting part is preferably provided with an electron gun, and an electric magnet to change the orbital of the electron beam generated from said electron gun and input it into the vacuum container. Said electron beam transporting part is preferably provided with an electric magnet or a converging lens to change the orbital of the electron beam to outside of the vacuum container, and the

electron beam or X-ray passing through the electron beam transporting part is scanned. Also, the accelerating apparatus is of the high frequency accelerating system or induction accelerating system, and is preferably provided with at least a continuous outputting or a pulse oscillator.

[0015] In accordance with the above-mentioned aspect, by the electron beam being efficiently accelerated by an alternating gradient electric magnet and an accelerating apparatus using high frequency or others, a fixed-field alternating gradient electron accelerator is offered which selectively generates the electron beam and X-ray from said electron beam, more than about ten times by such conventional electron accelerator as a LINAC. Also by continuous wave (CW) or pulse output, a high frequency oscillator of low output can be used as an accelerating apparatus, thereby it can be manufactured as compact and light-weighted and at low cost.

[0016] Also the electron accelerator of the present invention is the fixed-field alternating gradient electron accelerator comprising a vacuum container, an electric magnet provided to inside or outside of said vacuum container, an electron beam inputting part to input electron beam into said vacuum container, an accelerating apparatus to accelerate electron beam, an electric magnet to output the electron beam accelerated in said vacuum container, and an electron beam transporting part to transport the accelerated electron beam from said vacuum container, characterized in that said electric magnet is an alternating gradient electric magnet, said alternating gradient electric magnet consists of the alternating gradient electric magnet and a divergent electric magnet provided at both sides of said alternating gradient electric magnet, or of the alternating gradient electric magnet and a divergent part provided at both sides of said alternating gradient electric magnet, and the electron beam output from said electron beam transporting part is scanned.

[0017] In the aspect mentioned above, an internal target is preferably provided to generate X-ray in the vacuum container right before the accelerated electron beam transporting part, and the accelerated electron beam and X-ray can be selectively output. The electron beam or X-ray is preferably scanned by a scanning part including at least a pinhole slit.

[0018] In accordance with the aspect mentioned above, the electron beam and X-ray generated from said electron beam, more than about ten times by

such conventional electron accelerator as a LINAC can be obtained, and a fixed-field alternating gradient electron accelerator can be offered which can scan electron beam or X-ray. Also by continuous or pulse output, a high frequency oscillator of low output can be used as an accelerating apparatus, thereby it can be manufactured as compact and light-weighted and at low cost.

[0019] In the aspect mentioned above, said electron beam transporting part preferably consists of a septum electric magnet of a converging lens to change the orbital of electron beam to outside of said vacuum container, and a first electric magnet for electron beam orbital adjustment is provided near the electron beam outputting part of the alternating gradient electric magnet in said vacuum container. Said first electric magnet for electron beam orbital adjustment is preferably set in the position $\pi/2$ radian delayed in the electron beam phase space with respect to said septum electric magnet or said converging lens. In accordance with the above-mentioned aspect, by providing the first electric magnet for electron beam orbital adjustment, the electron beam of higher intensity can be obtained.

[0020] In the aspect mentioned above, a second electric magnet for electron beam orbital adjustment is preferably provided near the electron beam inputting part of the alternating gradient electric magnet, and said second electric magnet for electron beam orbital adjustment adjusts the electron beam orbital together with the first electric magnet for electron beam orbital adjustment. The first and the second electric magnets for electron beam orbital adjustment are preferably provided in the position in relative relation of n π radian (where n is an integer) in the electron beam phase space. In accordance with this aspect, by providing further the second electric magnet for electron beam orbital adjustment, the electron beam of higher intensity can be obtained.

[0021] In the aspect mentioned above, the coil part of the electric magnet constituting the alternating gradient electric magnet preferably has a divided coil structure, and each current of the divided coil part is drive-controlled so that pre-designed magnetic field distribution is attained. In accordance with this aspect, with the alternating gradient electric magnet as that of divided coil structure, magnetic field distribution can be adjusted by drive-controlling each current of coil part, thereby continuous electron

beam of higher intensity can be obtained.

[0022] Also the electron accelerator of the present invention is the fixed-field alternating gradient electron accelerator comprising a vacuum container, an electric magnet provided to inside or outside of said vacuum container, an electron beam inputting part to input electron beam into said vacuum container, an accelerating apparatus to accelerate electron beam, an electric magnet to output the electron beam accelerated in said vacuum container, and an electron beam transporting part to transport the accelerated electron beam from said vacuum container, characterized in that said electric magnet is an alternating gradient electric magnet, said alternating gradient electric magnet consists of the converging electric magnet and a divergent electric magnet provided at both sides of said converging electric magnet, or of the converging electric magnet and a divergent part provided at both sides of said converging electric magnet, the coil part of the electric magnet constituting the alternating gradient electric magnet has a divided coil structure, and each current of the divided coil part is drive-controlled so that pre-designed magnetic field distribution is attained.

[0023] In the aspect mentioned above, the each current of the divided coil part is preferably either controlled by the resistance connected in parallel with each coil part, or controlled by the current source connected to each coil part.

[0024] In the aspect mentioned above, since said alternating gradient electric magnet has a divided coil structure, the current of each coil part can have the optimal magnetic field distribution, thereby the electron beam of higher intensity can be obtained. Since the electric magnet is driven by direct current, and the accelerating apparatus can use a high frequency oscillator of higher than audible frequency, so noise is not generated from the electron accelerator.

[0025] Also, the radiation medical treatment apparatus using the electron accelerator of the present invention comprises an electron accelerator selectively generating electron beam or X-ray, an irradiation head, a supporting part, and a treatment bed on which a patient lies, characterized in that said electron accelerator is a fixed-field alternating gradient electron accelerator. In accordance with this aspect, since a fixed-field alternating

What is claimed is:

1. A fixed-field alternating gradient electron accelerator comprising:

a vacuum container;

an electric magnet provided inside or outside of said vacuum container;

an electron beam inputting part to input electron beam into said vacuum container;

an accelerating apparatus to accelerate said electron beam; and

an electron beam transporting part to transport the accelerated electron beam from said vacuum container,

characterized in that said electric magnet is an alternating gradient electric magnet, and said alternating gradient electric magnet is made up either with a converging electric magnet and divergent electric magnets provided at both sides of said converging electric magnet, or with a converging electric magnet and divergent parts provided at both sides of said converging electric magnet,

an internal target to generate X-ray is provided inside the vacuum container right before said electron beam transporting part, and

said accelerated electron beam and said X-ray can be selectively output.

2. An electron accelerator as set forth in claim 1, characterized in that said electron beam inputting part is provided with an electron gun, and an electric magnet to change the orbital of the electron beam generated from said electron gun, and to input the electron beam into said vacuum container.

3. An electron accelerator as set forth in claim 1, characterized in that said electron beam transporting part is provided with an electric magnet or a converging lens to change the orbital of the electron beam to outside of said vacuum container, and said

electron beam or said X-ray passing said electron beam transporting part is scanned.

4. An electron accelerator as set forth in any one of claims 1 to 3, characterized in that said accelerating apparatus is either of the high frequency acceleration system or of induction acceleration system, and is provided with at least a continuous output or a pulse oscillator.

5. A fixed-field alternating gradient electron accelerator comprising:

a vacuum container;

an electric magnet provided inside or outside of said vacuum container;

an electron beam inputting part to input electron beam into said vacuum container;

an electric magnet to output the accelerate electron beam in said vacuum container; and

an electron beam transporting part to transport the accelerated electron beam from said vacuum container,

characterized in that said electric magnet is an alternating gradient electric magnet, and said alternating gradient electric magnet is made up either with a converging electric magnet and divergent electric magnets provided at both sides of said converging electric magnet, or with a converging electric magnet and divergent parts provided at both sides of said converging electric magnet, and

the electron beam output from said electron beam transporting part is scanned.

6. An electron accelerator as set forth in claim 5, characterized in that an internal target to generate X-ray is provided inside the vacuum container right before said accelerated electron beam transporting part, and said accelerated electron beam and said X-ray can be selectively output.

7. An electron accelerator as set forth in claim 5 or claim 6, characterized in that said electron beam or X-ray is scanned by a scanning part including at least a pinhole slit.

8. An electron accelerator as set forth in any one of claims 5 to 7, characterized in that said electron beam transporting part is provided with a septum electric magnet or a converging lens to change the orbital of the electron beam to outside of said vacuum container, and a first electric magnet for electron beam orbital adjustment is provided near the electron beam outputting part of said alternating gradient electric magnet.

9. An electron accelerator as set forth in claim 8, characterized in that said first electric magnet for electron beam orbital adjustment is provided in the position delayed by $\pi/2$ radian in the electron beam phase space with respect to said septum electric magnet or a converging lens.

10. An electron accelerator as set forth in any one of claims 5 to 8, characterized in that a second electric magnet for electron beam orbital adjustment is provided near the electron beam inputting part of said alternating gradient electric magnet, and said second electric magnet for electron beam orbital adjustment adjusts the orbital of electron beam together with said first electric magnet for electron beam orbital adjustment.

11. An electron accelerator as set forth in claim 10, characterized in that said first and second electric magnets for electron beam orbital adjustment are provided at the position so their relation is $n\pi$ radian (where n is an integer) in electron beam phase space.

12. An electron accelerator as set forth in claim 5, characterized in that a coil part of the electric magnet constituting said alternating gradient electric magnet has divided coil structure,

and each current of said divided coil part is drive-controlled so as to have the pre-designed magnetic field distribution.

13. A fixed-field alternating gradient electron accelerator comprising:

a vacuum container;

an electric magnet provided inside or outside of said vacuum container;

an electron beam inputting part to input electron beam into said vacuum container;

an accelerating apparatus to accelerate said electron beam;

an electric magnet to output the accelerate electron beam in said vacuum container; and

an electric magnet to output the accelerate electron beam in said vacuum container, and

an electron beam transporting part to transport the accelerated electron beam from said vacuum container,

characterized in that said electric magnet is an alternating gradient electric magnet, and said alternating gradient electric magnet is either an alternating gradient electric magnet made up with a converging electric magnet and divergent electric magnets provided at both sides of said converging electric magnet, or is made up with a converging electric magnet and divergent parts provided at both sides of said converging electric magnet, and

a coil part of the electric magnet constituting said alternating gradient electric magnet has divided coil structure, and each current of said divided coil part is drive-controlled so as to have the pre-designed magnetic field distribution.

14. An electron accelerator as set forth in claim 13, characterized in that each current of said divided coil part is controlled by a resistance connected in parallel with respective coil part.

15. An electron accelerator as set forth in claim 13,

characterized in that each current of said divided coil part is controlled by a current source connected to respective coil part.

16. A radiation medical treatment apparatus using an electron accelerator, comprising:

an electron accelerator to selectively generate electron beam or X-ray;

an irradiation head;

a supporting part; and

a medical treating bed on which a patient lies,

characterized in that said accelerator is a fixed-field alternating gradient electron accelerator.

17. A radiation medical treatment apparatus using an electron accelerator, comprising:

an accelerator to selectively generate electron beam or X-ray;

an irradiation head;

a supporting part; and

a medical treating bed on which a patient lies,

characterized in that said electron accelerator is the electron accelerator as set forth in any one of claims 1 to 15.